

CLAIMS:

1. A device for reducing echo for an arrangement for transmitting audio signals, in particular uttered speech, having:

- an echo reduction unit (4), which is arranged between an input channel (1) for receiving an input audio signal (A1) coming from a remote end and an output channel (5) for outputting an output audio signal (A2), for suppressing an echo signal contained in the output audio signal (A2),

- a speech activity detection unit (7) for detecting a speech signal contained in the input audio signal (A1), and,

- a control unit (6) for setting an echo suppression factor (s) of the echo reduction unit (4) for echo suppression,

characterized in that the control unit (6) is so designed that the echo suppression factor (s) is reduced gradually and continuously from a high echo suppression value set while a speech signal is present in the input audio signal (A1) to a low echo suppression value if the speech activity detection unit (7) detects that the input audio signal (A1) does not contain any speech signal.

2. A device as claimed in claim 1, characterized in that the control unit (6) is so designed that reduction of the echo suppression factor (s) takes place exponentially from the high echo suppression value to the low echo suppression value.

3. A device as claimed in claim 2, characterized in that reduction of the echo suppression factor (s) takes place in accordance with the function $s[k] = \alpha \cdot s[k - 1] + (1 - \alpha) \cdot s_{\text{low}}$, wherein $s[k]$ is the echo suppression value at the time k, α is a factor representing the exponential reduction behavior and s_{low} is the minimum echo suppression value.

4. A device as claimed in claim 3, characterized in that the minimum suppression value s_{low} exhibits a value in the range from 0.1 to 1, preferably approximately 0.5, and the factor α representing the exponential reduction exhibits a value in the range from 0.5 to 0.99, preferably in the range from 0.75 to 0.85.

5. A device as claimed in claim 1, characterized in that the control unit (6) is designed for time delay of the reduction of the echo suppression factor (s) from the set high echo suppression value to the low echo suppression value by a dead time, in particular in the range from 0.1 to 1 second, preferably approximately 0.4 second.

6. A device as claimed in claim 1, characterized in that a second speech activity detection unit (427) is provided for detection of a speech signal contained in the echo-reduced audio signal (r) fed to the echo reduction unit (4) and coming from a near end and in that the control unit (6) is so designed that the echo suppression factor (s) is set to the high echo suppression value if the input audio signal contains a speech signal and the echo-reduced audio signal (r) does not contain a speech signal coming from the near end, and in that the echo suppression factor (s) is set to a medium echo suppression value lying between the high and low echo suppression values, if the input audio signal (A1) contains a speech signal and the echo-reduced audio signal (r) contains a speech signal coming from the near end.

7. A device as claimed in claim 1, characterized in that the echo reduction unit (4) comprises an adaptive FIR echo filter (40) for determining an estimated echo signal (e) and in that the coefficients of the adaptive FIR echo filter (40) are initialized at the start of the reception of the input audio signal (A1) to a value unequal to zero.

8. A device as claimed in claim 7, characterized in that the control unit (6) is so designed that the echo suppression factor (s) is set to a maximum start echo suppression value at the start of the reception of the input audio signal (A1) and is then reduced continuously, especially linearly, while a speech signal is present in the input audio signal (A1) to a stationary high echo suppression value.

9. A device as claimed in claim 8, characterized in that the time period for reducing the echo-suppression factor (s) from the maximum start echo suppression value to the static high echo-suppression value is so set that it corresponds approximately to the adaptation duration of the adaptive FIR echo filter (40).

10. A device as claimed in claim 9, characterized in that the maximum start echo-suppression value lies in the range between 5 and 15, in particular around approximately 10, and in that the static high echo-suppression value lies approximately in the range from 1 to 2, in particular approximately in the range of 1.5.

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11. A method for reducing echo in the transmission of audio signals, in particular in uttered speech, having the steps of:

- echo suppression for suppressing an echo signal (A1) of an input audio signal (A1) contained in an output audio signal (A2),

10 - detection of a speech signal contained in the input audio signal (A1), and

- setting of an echo suppression factor (s) for the suppression of echo,

characterized in that the echo-suppression factor (s) is reduced gradually and continuously from a high echo-suppression value set while a speech signal is present in the input audio signal (A1) to a low echo-suppression value if it is detected that the input audio
15 signal (A1) does not contain any speech signal.

12. A computer program with computer programming means for causing a computer to execute the method steps of the method as claimed in claim 11, if the method is executed on a computer.

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